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(54) Thermal beacon ignitor circuit.

(57) An intercepting circuit (10) to monitor the electrical current demands (8) of a missile (41) and activate a selected device (21) when the electrical current demands decrease to a predetermined level. The invention permits the retrofit of missiles with mechanisms that would tax or otherwise exceed the electrical capabilities of the missile system.

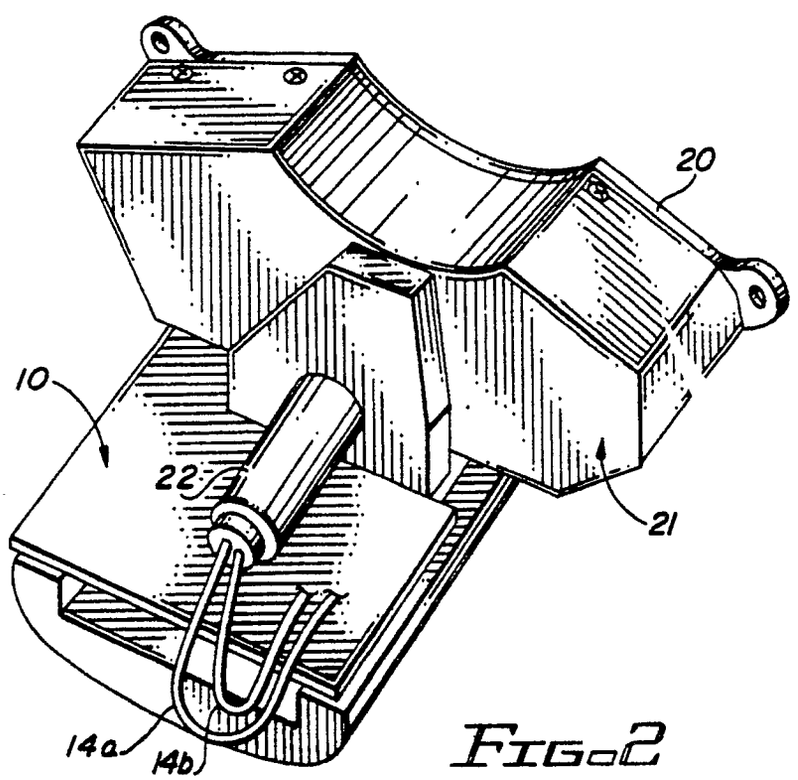

FIG. 2

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THERMAL BEACON IGNITOR CIRCUIT

BACKGROUND OF THE INVENTION

Field of the Invention:

This invention relates generally to tube-launched missiles and particularly to a method of upgrading a missile to incorporate advances in technology.

Description of Related Art:

Advancements in technology force a missile to be upgraded. These advancements can be in the in warheads, guidance systems, materials, or even fundamental design changes. When it is possible, these advancements are incorporated into the missile in such a way that the basic missile doesn't become antiquated or obsolete.

To facilitate the incorporation of technological advancements, many missiles have become modular in nature. This means, for example, that the propulsion unit is practically a stand-alone unit having a standardized interface with other modules of the missile such as the electronics module, the warhead module, etc.

Modularity requires that the interfaces between the modules be "standardized" so that an upgraded module does not necessitate changes in other modules.

For a tube-launched missile, this requirement for "standardization" applies not just to the missile itself, but also to the launcher/ case. The launcher or missile case contains the missile prior to launch and provides not only information to the tube-launched missile but also an initial electrical current flow.

Often the incorporation of a technological advancement changes the electrical current demands of the missile. Although missiles are originally designed with an excess margin of current, in some applications, the current requirements of a particular advancement will exceed this margin. In this situation, short of redesigning the entire case/ launcher and missile, it is impossible to incorporate the technological advancement. In such a case, the particular upgrade cannot be incorporated into the missile and the missile stands to become obsolete.

It is also known that electrical current for of a missile in pre-launch is needed primarily to start the components that will be used to guide and propel the missile in flight. Start-up is accomplished by firing squibs to activate such devices as the gyros or to initiate the operation of the flight batteries.

As example, assume that a tube-launched missile has a ten amperes capacity. Also assume that the squibs for two batteries and a gyro system, each requiring two amperes, must be fired prior to flight, giving a total requirement of six ampreres. The excess margin is therefore only four amperes. Should a technological advancement to the missile require five amperes to operate or begin operation, it could not be incorporated without alterations to the launcher/ case or other missile components. In addition, even if current requirements fall within the margin of four amperes, no margin would be left for error and the entire missile system could easily fail.

SUMMARY OF THE INVENTION

The present invention takes advantage of an important attribute of a missile's pre-launch electrical current supply, it is not constant. As internal missile devices are activated, they do not continue to require the same electrical current; hence, in pre-launch, the current demands of a missile decrease over time.

The present invention recognizes that the current required by the activation of the batteries and the gyros is only temporary and decreases dramatically once the squibs have been blown. By monitoring the return line, it can be determined when the squibs have blown and when there is enough electrical current available, with a margin of safety, for the circuit to utilize the electrical current from the launcher to power some other device, such as the technological advancement.

Similarly, the invention recognizes that some technological advances, such as a thermal beacon for a

tube-launched missile, do not require modification of the entire module but can be added on as a kit.

This task is accomplished by interposing the circuit of the present invention between existing mating connectors in the wire harness that normally carries the electrical current to the missile. In this manner, the other components of the missile and the launcher remain totally unaware of the new technological advancement which has been added to the missile since its operation has limited affect on these components.

This ability of the present invention to be unobtrusively placed in the wire harness line, permits the invention to intercept and monitor electrical current demands of the missile without requiring extensive modification or re-engineering of the missile.

The invention will be more fully explained by the ref ere.ce to accompanying drawings and the description.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic of the circuitry of the preferred embodiment of the invention.

Figure 2 is a perspective view of an embodiment of the invention utilized to ignite a thermal source/ beacon.

Figure 3 is an aft-end view of an embodiment of the invention incorporated into a tube-launched missile.

Figure 4 is a block-diagram of a tube-launched missile system utilizing the preferred embodiment of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 is a circuit diagram of the preferred embodiment of the invention, that which is used to ignite a thermal beacon.

Circuit 10 intercepts the signals from the wire harness (not shown) by utilizing connector 11a and connector 11b. These connectors mate with the case connector 12a and the missile connector 12b respectively. This arrangement permits certain lines 13a and 13b to be pass directly through without modification or interception.

Within circuit 10, the prefire return 18 is monitored via circuitry 8. Circuit 8 determines when sufficient electrical current is available to ignite the beacon (not shown) via leads 14a and 14b. Resistor R3, 17, is used to monitor the return electrical flow to determine when there is sufficient electrical current.

The source of the electrical current is via lead 9 which communicates with fusible resistors 16a and 16b to lead 14a.

Resistor 15 permits the circuitry 10 to identify itself to the operator. Lead 19 is used to test the circuitry 8 both in production and once circuit 10 has been installed in the missile (not shown).

In this manner, the electrical current demand of the missile can be monitored and when the electrical demands are reduced to a predetermined level, the beacon ignitor of this embodiment can be activated.

In this preferred embodiment, Table A indicates the preferred commercially available part numbers:

TABLE A

Identifer	Description	Part Number
R1	Resistor	RNC55H4021FR
R2	Resistor	RNC55H1540FR
R3	Resistor	RW79U00R1F
R4A	Fusible Resistor	MIS-13657-3
R4B	Fusible Resistor	MIS-13657-3
Rid	Resistor	RNC55H *
CR1	Semiconductor-Diode	JANTXIN3600
Q1	Thyristor	2N2324SJAN

(* Value of Resistor Depends on the Missile Identification)

Although the present description, and those following refer to the use of the invention to ignite a thermal beacon, those of ordinary skill in the art readily recognize that the invention can be used whenever an electrical current load mechanism is being fitted into an existing missile missile system.

A perspective of the preferred embodiment of the invention is given in Figure 2. The intercepting circuit 10 communicates the electrical current to ignitor 22 via leads 14a and 14b.

Thermal beacon 21 is activated by ignitor 22 and is secured in place to the missile (not shown) by frame 20.

In this manner, a retrofit kit is created which can be placed on the desired missile without having to alter the electrical characteristics of the entire missile by either changing the electrical current demands or by adding more powerful batteries.

The placement of the thermal beacon described in Figure 2 in a missile is illustrated in Figure 3. Figure 3 is a view of the aft end of a tube-launched missile.

The intercepting circuit 10 and thermal beacon 21 are secured to the missile via screws 31a and 31b. Connector 32, which is connectable to the wire harness (not shown), is clearly accessible by the operator. The intercepting circuit 10 utilizes it's second connector (not shown in this illustration) to connect to the connector from the missile (also not shown). In this manner, the thermal beacon 21 and the intercepting circuit 10 are installed in the missile without any undue modification thereto.

The preferred embodiment of the invention utilizes a tube launched missile. In that embodiment, spools 30a and 30b unwind steel wires for operator direction of the missile. IR Source 33 helps to keep the launched missile on track.

Figure 4 illustrates the use of the preferred embodiment to create an enhanced missile system.

Missile 41 is secured for launching within case 40. Electrical current for pre-launch power-up of missile 41 is supplied by power supply 43 via wire harness 42. Intercepting circuit 10 monitors this electrical current and activates the thermal beacon (not shown) when sufficient electrical current is available.

In this manner, a missile which heretofore did not have the ability to have a thermal beacon due to limited battery capability, can now have this capability; thereby creating an enhanced missile system.

It is clear from the forgoing that the present invention cures a significant problem in enhancing missiles with technological advancements.

Claims

1. In a missile system of the type having a missile requiring electrical current during a pre-launch period, the improvement comprising:
   a) means for monitoring the electrical current of said missile during said pre-launch period (8); and,
   b) means for activating (16) a selected device within said missile during said pre-launch period when the electrical current of the missile decreases to a predetermined level.

2. The missile system according to claim 1 wherein said means for monitoring the electrical current demands include means for sensing a return electrical current flow (17) from said missile to said case.

3. The missile system according to claim 2 wherein said selected device within said missile is a thermal beacon (21).

4. A missile system comprising:
   a) a tube-launched missile (41) having electrical current demands;
   b) a missile launching case (40);
   c) a wire harness (42) , said missile receiving pre-launch electrical current from said launching case via said wire harness, said wire harness having a male connector (12a) and a female connector (12b); and
   d) an intercepting circuit (10) for monitoring the electrical current of said missile (8) and activating a selected device within said missile when the electrical current demands of the missile have decreased to a predetermined level.

5. The missile system according to claim 4 wherein said intercepting circuit further includes a female connector (11a) and a male connector (11b) and wherein said female connector of said intercepting circuit connects with the male connector of the wire harness and the male connector of said intercepting circuit connects with the female connector of the wire harness.

6. The missile system according to claim 4 wherein said intercepting circuit further includes means for sensing a return electrical current flow (17) from said tube-launched missile to said launching case.

7. The missile system according to claim 4 wherein said selected device within said tube-launched missile is a thermal beacon (21).

8. A method of activating a selected device within a tube-launched missile (41) receiving electrical current from a launching case (40), the method comprising the steps of:

a) monitoring the electrical current demands of said tube-launched missile; and,

b) activating the selected device within said tube-launched missile when the electrical current demands of the tube-launched missile have decreased to a predetermined level.

9. The method of activating a selected device within a tube-launched missile according to claim 8 wherein the step of monitoring the electrical current demands includes the step of sensing a return electrical current flow from said tube-launched missile to said launching case.

10. The method of activating a selected device within a tube-launched missile wherein the step of activating a selected device includes the step of igniting a thermal beacon (21).

11. A missile system comprising:

a) a tube-launched missile (41) having electrical curren demands;

b) a case (40) for holding the tube-launched missile and providing pre-launch electrical current to the tube-launched missile;

b) a wire harness (42) communicating the electrical current from said case to the tube-launched missile, said wire harness having a connector composed of a male connector (12a) and a female connector (12b);

c) an intercepting circuit (10) interposed between the male connector and the female connector of said wire harness, said intercepting circuit monitoring the electrical current demands of said tube-launched missile (8) and activating a selected device within said tube-launched missile when the electrical current demands of the tube-launched missile have decreased to a predetermined level.

12. The missile system according to claim 11 wherein said intercepting circuit further includes a female connector (11a) and a male connector (11b) and wherein said female connector of said intercepting circuit connects with the male connector of the wire harness and the male connector of said intercepting circuit connects with the female connector of the wire harness.

13. The missile system according to claim 12 wherein said intercepting circuit further includes means for sensing a return electrical current flow from said tube-launched missile to said launching case (8).

14. The missile system according to claim 13 wherein said selected device within said tube-launched missile is a thermal beacon (21).

15. A kit for a missile system, said missile system having a missile (41) requiring electrical current, and a case (40) for holding the missile and providing pre-launch electrical current to the missile over a wire harness (42), said harness having a male connector (12a) and a female connector (12b), the kit comprising:

a) a preselected device (21) being disposable within said missile; and,

b) a circuit (10) being disposable between the male connector and the female connector of said wire harness and including,

1) means for monitoring the electrical current demands of said missile (8), and,

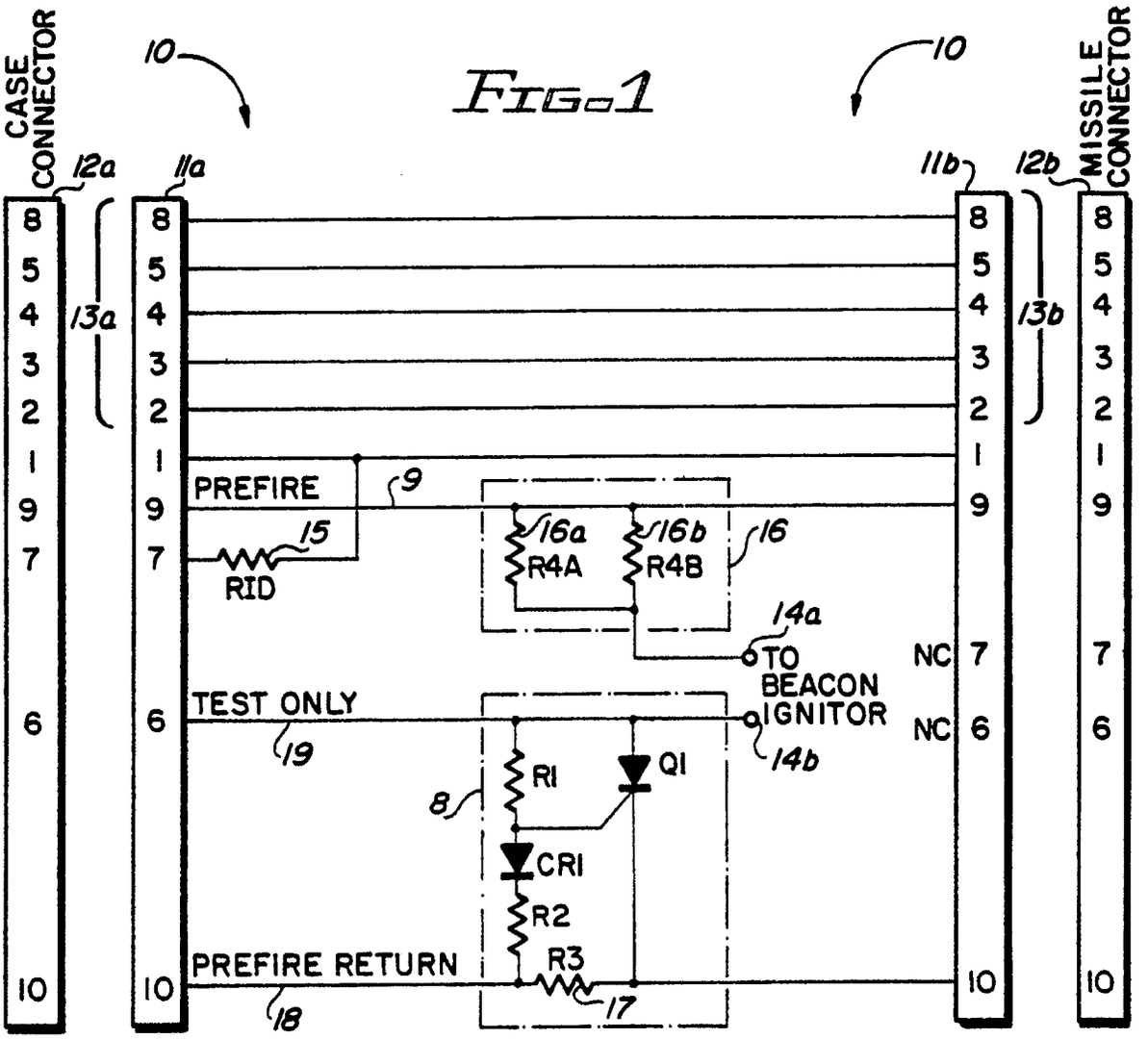
2) means for activating (16) the preselected device when the electrical current demands of the missile have decreased to a predetermined level.

16. The kit according to claim 15 wherein said circuit further includes a female connector (11a) and a male connector (11b) and wherein said female connector of said circuit is connectable with the male connector of the wire harness and the male connector of said circuit is connectable with the female connector of the wire harness.

17. The kit according to claim 16 wherein said means for monitoring the electrical current demands includes means for sensing a return electrical current flow from said missile to sad case (17).

18. The kit according to claim 17 wherein said selected device is a thermal beacon (21).

FIG-1


CASE CONNECTOR
MISSILE CONNECTOR
10
12a
11a
11b
12b
13a
13b
PREFIRE
9
15
RID
16a
R4A
16b
R4B
16
14a
TO BEACON IGNITOR
14b
TEST ONLY
19
RI
QI
8
CRI
R2
R3
17
PREFIRE RETURN
18
NC

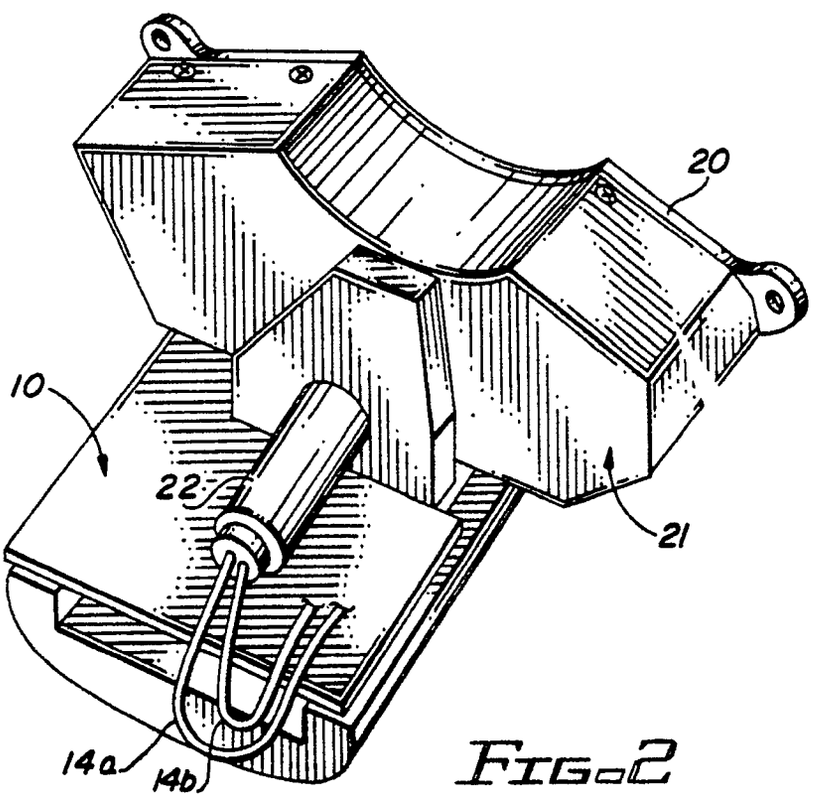
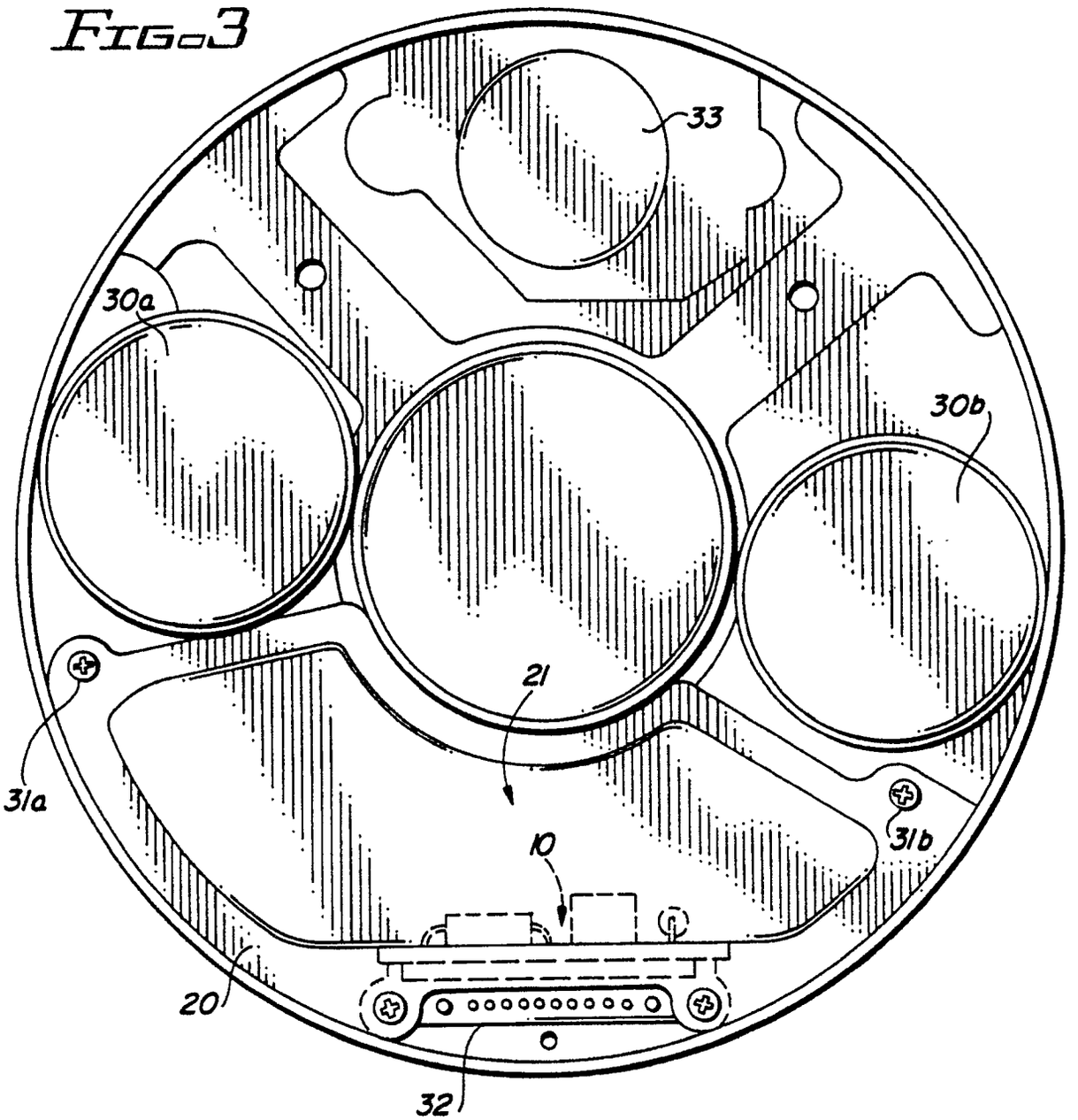

20
10
22
21
14a
14b

FIG-2

FIG.3



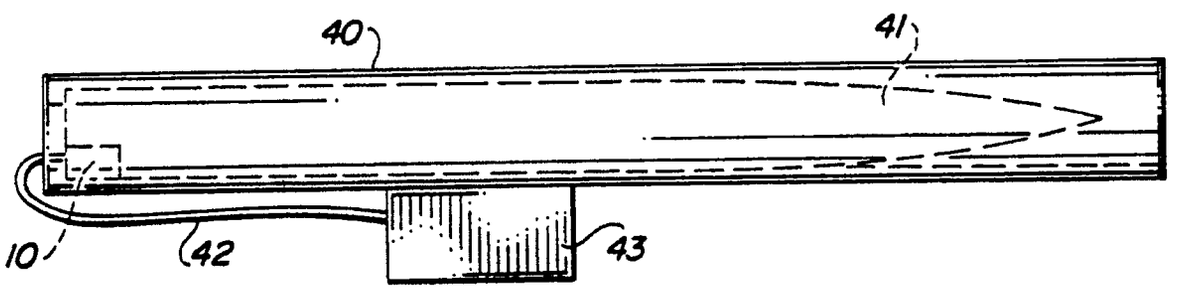


FIG.4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 90308977.9

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	EP - A1 - 0 230 637 (BBC BROWN, BOVERI & CIE) * Column 2, line 5 - column 6, line 37; fig. 1-10 *	1,2, 4-6, 8-10, 11-13, 15-17	F 42 B 15/00 F 41 F 3/055 H 01 R 13/66
Y	NÜHR, DAS GROSSE WERKBUCH ELEKTRONIK, Teil B; 1989 Franzis-Verlag München Pages 1922/1923 * Page 1923, last paragraph; fig. 4.2.2.2.-8 *	1,2, 4-6, 8-10, 11-13, 15-17	
Y	AT - B - 361 561 (GALL RICHARD) * Page 2, line 21,32,45 - page 3, line 4; lines 17-19; fig. 1 *	1,2, 4-6, 8-10, 11-13, 15-17	
A	E - B - 25 792 (CORABELMENT AG) * Totality *		TECHNICAL FIELDS SEARCHED (Int. Cl.5) F 41 F 3/00 F 41 G 7/00 F 41 J 2/00 F 42 B 15/00 H 01 R 13/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	10-12-1990	KALANDRA

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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